IJFANS INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES
ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, 2022

AGE-RELATED DIFFERENCES IN GAIT CYCLE WITH THE SYNCHRONIZED CONTRIBUTION USING G-SENSOR

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Abstract

Aim of the study was to examine the gait cycle in different age groups using g-sensor. The symmetry of left gait cycle and right gait cycle was analyzed with the help of finding. Method: Thirty (30) healthy female subjects were selected from L.N.I.P.E., Gwalior of age- ranged 14-20 years. Thirty subjects were divided into two experimental groups and one control groups. Each group was having ten subjects. Subjects' data were recorded with the help of G-walk BTS G-sensor smart analyzer. During data collection each subjects have to walk barefoot, at a self-selected speed on a ten-meter straight line, starting and finishing line was mark. Each subject was started behind the starting line of ten-meter and stopped after covering the ten-meter distance. Result: Balance training significantly influences selected age groups and significant change was found in 17-20 years age-groups in case of left to right gait cycle. The mean and S.D of treatment group1 (14-17 years) for left gait cycle was 96. 01 (±2.64), treatment group 2 (17-20 years) was 97.12 m (±2.23), control group was 97.26 (±1.38) and total mean and S.D of left gait cycle as 96.79 (±2.15) whereas for right gait cycle in case of treatment group 1 (14-17 years) was 96.31 (±2.91), treatment group 2 (17-20 years), as 96.78. (±2.30), control group 95.216 (±3.22) and total mean and S.D of right gait cycle as 96.10 (±2.82). On the basis of graph no.2, it can be concluded that the mean value was more in treatment group 2 as compare to treatment group 1 as well as with control group in case of left to right walk gait cycle. Graph 2 shown that the training was effective for treatment group 2 in term of left to right gait cycle as the mean value of treatment group 1, 2 and control group for left and right gait cycle were as follow: 96.01, 97.12, 97.26 and 96.31, 96.78, 95.21. On the basis of explained value treatment group 2 was having better mean value in left and right gait cycle as compare to other groups.

Keywords: Gait cycle, G-sensor, Age-groups, Girls.

INTRODUCTION

A gait is a walking style. Muscle balance and movement coordination are crucial when a person walks. One of the most used methods for evaluating human mobility is gait. Gait evolves with age, and by the time a child is 7 years old, it appears to be fully developed.(Müller et al., 2013).Although human gaits are assumed to be symmetrical, Asymmetrical behavior of the lower

extremities in healthy people can be caused by a number of causes. These include foot placement angle, range of joint mobility, lower limb dominance, ground reaction forces, lower limb muscular power, (Lin et al., 2022) A poor gait can increase the risk of falling, limit mobility, and possibly affect cognition.

Gait parameter training and physical activities help to reduce the rate of falls by approximately 25% and the number of older adults who experience falls by 15%. The motion of the human gait is symmetrical, regular, and rhythmic(Trombini-Souza et al., 2023). A healthy person's gait cycle normally has two symmetrical legs and is made up of roughly 60% stance phase and 40% swing phase. Therefore, the symmetry of leg motions can be used to evaluate gait performance. Gait information can be obtained using a variety of techniques. However, gains in walking abilities have a favourable impact on older people's quality of life and health, in part because daily walking considerably lowers the risk of chronic diseases including diabetes, osteoporosis, and cardiovascular disease in this older demographic(Gieysztor et al., 2021) **.** An alteration in walking style is known as an abnormal gait. Everybody has a different fundamental gait. On the other hand, accidents and illnesses might alter your gait. Your gait can be altered by anything that affects your brain, spinal cord, legs, or feet. Common manifestations of an irregular gait include falling down, dragging the toes, taking short steps, having trouble bearing one's own weight, and having trouble coordination one's movements(Bissolotti et al., 2015). Abnormal gait is a change in walking pattern. Everyone's natural walking style is unique. However, injuries and medical conditions can affect your walking pattern. Anything that affects your brain, spinal cord, legs or feet can change your gait. Some common examples of an abnormal gait include: Limping, dragging toes, short steps, difficulty in supporting the body weight, trouble in coordination. A wearable device was utilised to gather kinematic data and to assess gait behaviors and postural balance during regular walking, paired walking, and single-leg stance. It can record 3-axis accelerometers, 3-axis gyroscopes, and 3-axis magnetometers(*G-SENSOR 2 Hardware Manual ENG v.1.3.0,* n.d.)

This study wanted to examine the gait quality index using various gait training techniques in various environments. Compared to controls of same age and development, gait performance and balancing ability were enhanced by biomechanical analysis.

MATERIAL AND METHODS

Subjects

Thirty (30) healthy female subjects were selected from L.N.I.P.E., Gwalior of age range 14-20 years. Thirty subjects were divided into two experimental groups and one control groups. Each group was having ten subjects. Treatment group 1 was from 14 to 17 years, treatment group 2 was from 17 to 20 years and third group was control groups. Treatment groups were attended the three-day regular training program up to six weeks based on gait parameters. Subjects were selected randomly for the purpose of study

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Variables

Gait Parameters

1. Left gait cycle
2. Right gait cycle

Training Protocol based on gait parameter

Days	14-17years	17-20 years	Set X Rep.
Monday	Warmup, walk on straight line, walk between two lines, walk in close eyes for 10meter.		3X5
Tuesday		Warmup, walk on straight line, walk between two lines, walk in close eyes for 10meter.	3X5
Wednesday	Warmup, walk on straight line, walk between two lines, walk in close eyes for 10meter.		3X5
Thursday		Warmup, walk on straight line, walk between two lines, walk in close eyes for 10meter.	3X5
Friday	Warmup, walk on straight line, walk between two lines, walk in close eyes for 10meter.		3X5
Saturday		Warmup, walk on straight line, walk between two lines, walk in close eyes for 10meter.	3X5

Training sets and repetitions were increases as the week increase and recovery was given on the basis of subject's adaptation.

Administration of test and collection of data

With the help of wireless g-sensor data was recorded in research laboratory of Lakshmibai National Institute of Physical education, Gwalior. Before data collection, demonstration and explanation was given by research scholar in the research lab. and subjects' details entry was made in the new patients database after that subjects wear the sensor belt and wireless sensor was fitted in the waistband pocket below the line of two dimples of the venus-lumbosacral canal, as s1 and s2 vertebrae (*G-SENSOR 2 Hardware Manual ENG v.1.3.0,* n.d.) for the purpose of data collection each subjects have to walk for 10meter in straight

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 UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, 2022

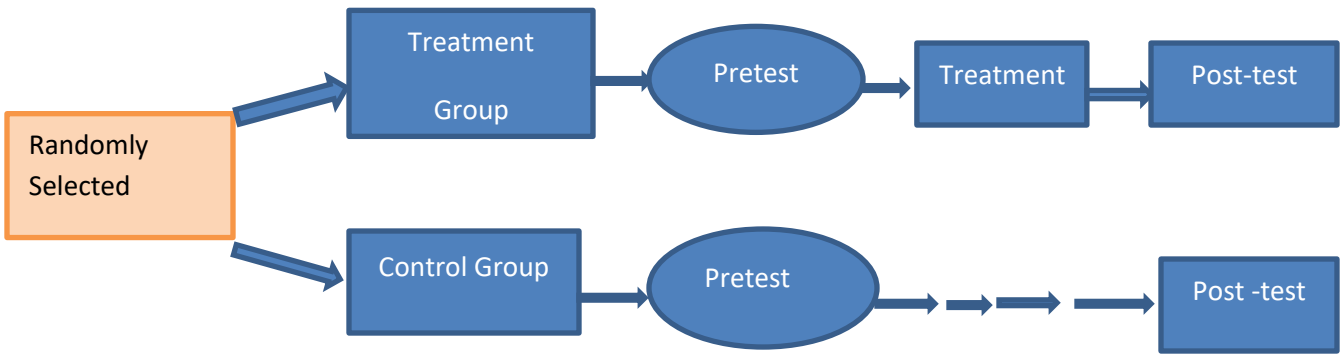
line, starting and finishing line was mark. Each subject starts behind the starting line, on command go subjects walks in a straight line and stop at the finishing line.

Figure. 1 Position of the G-Sensor

Figure 2. Insert the sensor inside the belt, with the flat part facing towards the back of the pocket.

Research Design

Pre-Post test Randomized ERD



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Statistical Analysis

Analysis of Co-Variance (ANCOVA) technique was used to find out the effect of gait cycle on selected age groups. The level of significance was set at 0.05

RESULTS

A total of 30 (thirty) subjects were divided in two treatment groups and one control group. Each group consist of ten subjects, treatment groups were attended the three-day training in a week, training of gait parameter for six weeks. Whereas the control groups did not receive any training. Each subject was tested for 10meter straight line walk. Data was recorded before commencement of the treatment and after six weeks of training period. The data was examined by applying analysis of covariance (ANCOVA). Analysis of covariance was applied with regard to experimental groups and control groups at both levels as the pretest – posttest, randomized group design was employed in this study. Hence, the difference between initial means of the groups at pre – test had to be taken into account during analysis of post – test differences between the means by the process of application of ANCOVA where the final means were adjusted for the difference in the initial means and adjusted means (Singh, 2016) were tested for significance at .05 level.

The table of results shows the descriptive statistics as means, standard deviations, between subjects' effects as mean square, f-value, significant value, estimated marginal mean in case of post gait cycle, pairwise comparisons, and graphs of gait cycle.

Table 1. Shows the Descriptive Statistics

Dependent Variable: Post_ gait cycle

gait cycle _Quality index	Selected_Age Groups	Mean	Std. Deviation	N
Left gait cycle	Treatment group 1	96.0100	2.64552	10
	Treatment group 2	97.1200	2.23000	10
	Control group	97.2600	1.38339	10
	Total	96.7967	2.15238	30
Right gait cycle	Treatment group 1	96.3100	2.91450	10
	Treatment group 2	96.7800	2.30882	10
	Control group	95.2100	3.22058	10
	Total	96.1000	2.82086	30
Total	Treatment group 1	96.1600	2.71340	20
	Treatment group 2	96.9500	2.21609	20
	Control group	96.2350	2.63164	20
	Total	96.4483	2.51231	60

The mean and S.D of treatment group1 (14-17 years) for left gait cycle was 96. 01 (±2.64), treatment group 2 (17-20 years) was 97.12 m (±2.23), control group was 97.26 (±1.38) and total mean and S.D of left gait cycle as 96.79 (±2.15) whereas for right gait cycle in case of treatment

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group 1 (14-17 years) was 96.31 (±2.91), treatment group 2 (17-20 years), as 96.78. (±2.30), control group 95.216 (±3.22) and total mean and S.D of right gait cycle as 96.10 (±2.82). From descriptive table the mean and S.D of left gait cycle for treatment group 2 and control group is approximately same than right gait cycle. In case of right gait cycle, the mean and S.D of treatment group 1 and treatment group 2 was approximately same as compare to control group.

Table 2

ANCOVA BETWEEN TREATMENT GROUP AND CONTROL GROUP FOR 10METER STRAIGHT GAIT CYCLE FOR PRE AND POST TEST

Dependent Variable: Post Gait Cycle

Source	Type I Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	86.171[a]	6	14.362	2.659	.025	.231
Intercept	558136.860	1	558136.860	103352.014	.000	.999
Pre_Walk	**47.462**	**1**	**47.462**	**8.789**	**.005**	**.142**
Treatment	8.662	1	8.662	1.604	.211	.029
Error	286.218	53	5.400			
Total	558509.250	60				
Corrected Total	372.390	59				

a. R Squared = .231 (Adjusted R Squared = .144)

Table no.2 shown the 'F' value for treatment group as 1.604 for 10meter gait cycle, which was recorded to be insignificant at 0.05 levels with 1/53 df as the tabulated value of 8.66 required to be insignificant at 0.05 level. This table also indicated that there was insignificant difference in adjusted means of 10 meters straight gait cycle between treatment group and control group.

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Estimated Marginal Means

Gait cycle

Table 3. Shows the value of Estimated mean in case of post gait cycle
Dependent Variable: Post_ gait cycle

Gait cycle	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Left gait cycle	96.831[a]	.424	95.980	97.682
Right gait cycle	96.065[a]	.424	95.214	96.917

a. Covariates appearing in the model are evaluated at the following values: Pre_ gait cycle = 95.6400.

Table 4. Shows the value of Pairwise Comparisons
Dependent Variable: Post_ gait cycle

(I) Gait Cycle	(J) Gait Cycle	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
Left gait cycle	Right gait cycle	.766	.600	.208	-.438	1.970
Right gait cycle	Left gait cycle	-.766	.600	.208	-1.970	.438

Based on estimated marginal means
a. Adjustment for multiple comparisons: Bonferroni.

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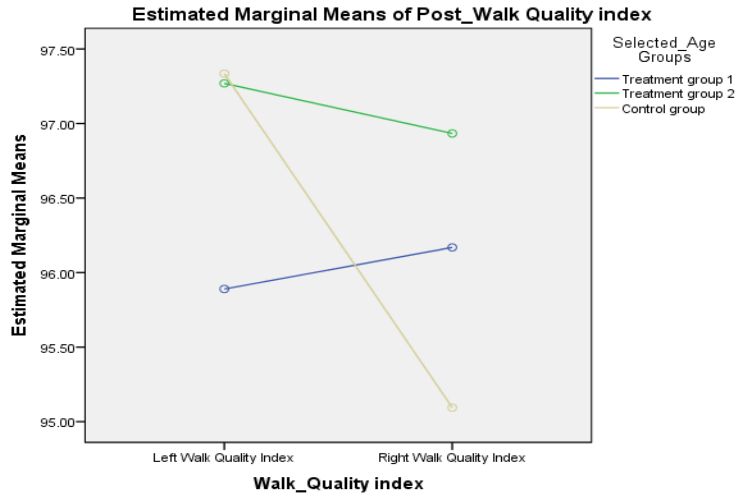
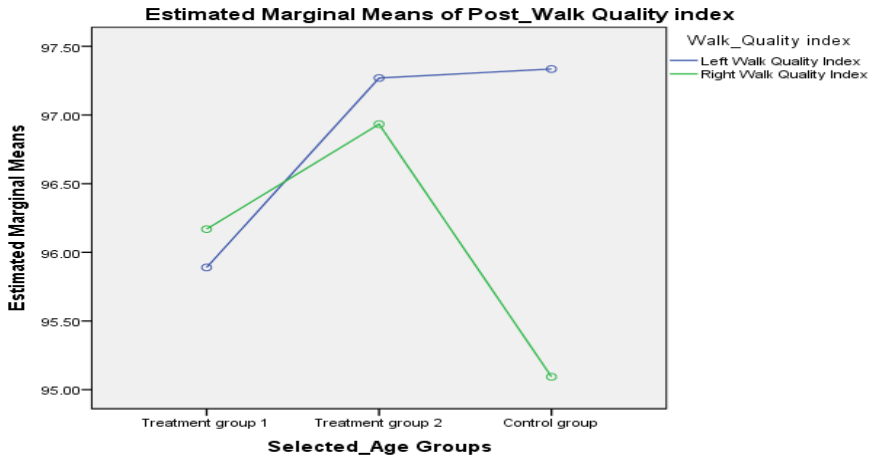
Table 5. Graph shows the value of estimated marginal means of post gait cycle



Covariates appearing in the model are evaluated at the following values: Pre_Walk Quality index = 95.6400

On the basis of graph, it can be concluded that the mean value of treatment group 1 was 96.01 & 96.31 for left to right gait cycle and the mean value for treatment group 2 was 97.12 & 96.78 for left to right gait cycle whereas for control group the mean value of left to right gait cycle was 97.26 & 95.21 so, the pattern of left to right gait cycle was similar in nature but in case of control group the mean difference in left to right gait cycle was slightly more as the mean of left gait cycle to right gait cycle was 97.26 and 95.21. This shows left gait cycle mean was more as compare to right gait cycle mean.



Covariates appearing in the model are evaluated at the following values: Pre_Walk Quality index = 95.6400

Whereas in graph 2, it shows that the mean value was more in treatment group 2 as compare to treatment group 1 as well as with control group in case of left to right gait cycle. This graph shown that the training was effective for treatment group 2 in term of left to right gait cycle as the mean

value of treatment group 1, 2 and control group for left and right gait cycle as follow: 96.01, 97.12, 97.26 and 96.31, 96.78, 95.21. On the basis of explained value treatment group 2 was having better mean value in left and right gait cycle as compare to other groups.

Discussion

From the table value as well as with the help of graph, the mean and S.D of treatment group 1. i.e., 14-17 years and treatment group 2. i.e., 17 -20 years and control group have nearly same mean and S.D but in case of treatment group 2, mean and S.D, value was better than treatment group 1 and control group in case of left and right gait cycle.

Conclusion

It can be concluded on the basis of mean, S.D and adjusted mean value that treatment group 2 (17-20 years) was having better gait cycle in case of symmetry index in left and right gait cycle as compare to treatment group 1 and control group.

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